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Search Results - Record(s) 1 through 3 of 3 returned.

☐ 1. Document ID: US 20020160378 A1

L9: Entry 1 of 3 File: PGPB Oct 31, 2002

PGPUB-DOCUMENT-NUMBER: 20020160378
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020160378 A1

TITLE: Stress-regulated genes of plants, transgenic plants containing same, and methods of use

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Image

☐ 2. Document ID: US 20020040490 A1

L9: Entry 2 of 3 File: PGPB Apr 4, 2002

PGPUB-DOCUMENT-NUMBER: 20020040490
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020040490 A1

TITLE: Expressed sequences of arabidopsis thaliana

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Image

☐ 3. Document ID: US 20020023280 A1

L9: Entry 3 of 3 File: PGPB Feb 21, 2002

PGPUB-DOCUMENT-NUMBER: 20020023280
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020023280 A1

TITLE: Expressed sequences of arabidopsis thaliana

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Image

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Terms	Documents
L8 and (barley or arabidopsis or oryza)	3

Display Format: - Change Format

Previous Page Next Page

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=> d his

     (FILE 'HOME' ENTERED AT 11:15:51 ON 15 NOV 2002)

     FILE 'REGISTRY' ENTERED AT 11:16:01 ON 15 NOV 2002
L1             1 S NICOTIANAMINE SYNTHASE/CN

     FILE 'HCAPLUS' ENTERED AT 11:16:26 ON 15 NOV 2002

     FILE 'REGISTRY' ENTERED AT 11:16:33 ON 15 NOV 2002
                SET SMARTSELECT ON
L2           SEL L1 1- CHEM :       2 TERMS
                SET SMARTSELECT OFF

     FILE 'HCAPLUS' ENTERED AT 11:16:33 ON 15 NOV 2002
L3            23 S L2
L4            19 S L3 (L) (BARLEY OR ARABIDOPSIS OR ORYZA)
L5             4 S L4 AND PD<19980430
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=> s nicotianamine synthase/cn
L1            1 NICOTIANAMINE SYNTHASE/CN

=> d

L1   ANSWER 1 OF 1  REGISTRY  COPYRIGHT 2002 ACS
RN   161515-44-2  REGISTRY
CN   Synthase, nicotianamine (9CI)  (CA INDEX NAME)
OTHER NAMES:
CN   Nicotianamine synthase
MF   Unspecified
CI   MAN
SR   CA
LC   STN Files:   AGRICOLA, BIOBUSINESS, BIOSIS, CA, CAPLUS, TOXCENTER

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
               19 REFERENCES IN FILE CA (1962 TO DATE)
               19 REFERENCES IN FILE CAPLUS (1962 TO DATE)
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=> d ibib ab 1-4

L5 ANSWER 1 OF 4 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1996:586037 HCAPLUS
DOCUMENT NUMBER: 125:239625
TITLE: A strategy for cloning the genes in the synthetic pathway of mugineic acid-family phytosiderophores
AUTHOR(S): Mori, S.
CORPORATE SOURCE: Faculty Agriculture, University Tokyo, Tokyo, 113, Japan
SOURCE: Genetic Manipulation of Crop Plants to Enhance Integrated Nutrient Management in Cropping Systems--1. Phosphorus, Proceedings ofan FAO-ICRISAT Expert Consultancy Workshop, Patancheru, India, Mar. 15-18, 1994 (**1995**), Meeting Date 1994, 129-144. Editor(s): Johansen, C. International Crops Research Institute for the Semi-Arid Tropics: Patancheru, India.
CODEN: 63KAAB
DOCUMENT TYPE: Conference
LANGUAGE: English
AB Genes involved in the biosynthetic pathway of mugineic acid-family phytosiderophores were cloned. Initially, the genes for **nicotianamine synthase** and nicotianamine aminotransferase were confirmed to be induced by iron (Fe) deficiency and were partially purified. The partial amino acid sequences of the "d" peptide were detd. on 2D-PAGE, which appeared to be specific to Fe-deficient **barley** roots. Finally, seven Fe-deficiency specific clones were selected by "differential screening" of a cDNA library constructed from Fe-deficient **barley** roots and three DNA clones (Ids1, Ids2, and Ids3) were sequenced from amongst these. Strategies to clone the genes essential for the synthesis of phytosiderophores are discussed.

L5 ANSWER 2 OF 4 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1996:202215 HCAPLUS
DOCUMENT NUMBER: 124:259698
TITLE: The role of nicotianamine synthase in response to Fe nutrition status in Gramineae
AUTHOR(S): Higuchi, Kyoko; Kanazawa, Kenji; Nishizawa, Naoko-Kishi; Mori, Satoshi
CORPORATE SOURCE: Dep. Appl. Biol. Chem., Univ. Tokyo, TOkyo, 113, Japan
SOURCE: Plant and Soil (**1996**), 178(2), 171-7
CODEN: PLSOA2; ISSN: 0032-079X
PUBLISHER: Kluwer
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Nicotianamine is an intermediate for the biosynthesis of mugineic acid-family phytosiderophores (MAs) in the Gramineae and a key substance for iron metab. in dicots. **Nicotianamine synthase** catalyzes the formation of nicotianamine from S-adenosylmethionine. **Nicotianamine synthase** activity was induced in **barley** roots at the 3rd day after withholding Fe supply and declined within one day following the supply of Fe3+-epihydroxymugineic acid. The induction **nicotianamine synthase** activity by Fe-deficiency was obsd. also in sorghum, maize, and rye, and the level of **nicotianamine synthase** activity was highly assocd. with the MAs secreted among graminaceous plant tested. Therefore, the **nicotianamine synthase** gene may be a suitable candidate for making a transgenic plant tolerant to Fe-deficiency.

L5 ANSWER 3 OF 4 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1995:771685 HCAPLUS
DOCUMENT NUMBER: 123:165182
TITLE: Response of **nicotianamine synthase** activity to Fe-deficiency in tobacco plants as compared with **barley**
AUTHOR(S): Higuchi, Kiyoko; Nishizawa, Naoko-Kishi; Yamaguchi, Hirotaka; Roemheld, Volker; Marschner, Horst; Mori,

Satoshi
CORPORATE SOURCE: Fac. Agric. Agric. Life Sci., Univ. Tokyo, Tokyo, 113, Japan
SOURCE: Journal of Experimental Botany (**1995**), 46(289), 1061-3
CODEN: JEBOA6; ISSN: 0022-0957
PUBLISHER: Oxford University Press
DOCUMENT TYPE: Journal
LANGUAGE: English
AB In vitro **nicotianamine synthase** activity was measured in tobacco under Fe-deficient or Fe-sufficient conditions. Its activity was not induced by Fe-deficiency, in contrast to **barley** roots, implying that the mol. biol. regulation of **nicotianamine synthase** in response to Fe-deficiency may be different between tobacco and **barley**.

L5 ANSWER 4 OF 4 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1995:319128 HCAPLUS
DOCUMENT NUMBER: 122:183289
TITLE: Purification and characterization of **nicotianamine synthase** from Fe-deficient **barley** roots
AUTHOR(S): Higuchi, Kyoko; Kanazawa, Kenji; Nishizawa, Naoko-Kishi; Chino, Mitsuo; Mori, Satoshi
CORPORATE SOURCE: Lab. Plant nutrition Fertilizers, Univ. Tokyo, Tokyo, 113, Japan
SOURCE: Plant and Soil (**1994**), 165(2), 173-9
CODEN: PLSOA2; ISSN: 0032-079X
PUBLISHER: Kluwer
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Nicotianamine (NA), the key precursor of the mugineic acid family phytosiderophores (MAs), is synthesized from S-adenosylmethionine (SAM). NA synthase was strongly induced by Fe-deficiency treatment, and the activity increased to the max. level faster than the time of max. level of MAs secretion and also before the appearance of severest chlorosis. The enzyme was mainly localized in the roots of barley. NA synthase had an optimum pH at 9.0, a mol. wt. of .apprx.40,000-50,000 estd. by gel filtration or .apprx.30,000 by SDS-PAGE. Using hydrophobic chromatog., hydroxylapatite chromatog., and preparative SDS-PAGE, NA synthase was purified as 1 band on SDS-PAGE.

=> d '14 ibib ab 1-19

L4 ANSWER 1 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 2002:482096 HCAPLUS
DOCUMENT NUMBER: 137:289578
TITLE: Nicotianamine synthase: Gene isolation, gene transfer and application for the manipulation of plant iron assimilation
AUTHOR(S): Douchkov, D.; Herbik, A.; Koch, G.; Mock, H.-P.; Melzer, M.; Stephan, U. W.; Baeumlein, H.
CORPORATE SOURCE: Institut fuer Pflanzengenetik und Kulturpflanzenforschung (IPK), Gatersleben, D-06466, Germany
SOURCE: Plant and Soil (2002), 241(1), 115-119
CODEN: PLSOA2; ISSN: 0032-079X
PUBLISHER: Kluwer Academic Publishers
DOCUMENT TYPE: Journal; General Review
LANGUAGE: English
AB Basic cellular processes such as electron transport in photosynthesis and respiration require the precise control of iron homeostasis. To mobilize iron, plants have evolved at least two different strategies. The non-proteinogenic amino acid nicotianamine is an essential component of both pathways. We review the characterization of the **nicotianamine synthase** as a member of a novel class of enzymes, the cloning of the corresponding gene coding sequences of **barley**, **Arabidopsis** and tomato as well as the mol. basis of the chloronerva mutant exhibiting severe defects in the regulation of iron metab. Further, we report on current expts. utilizing various NAS-genes to manipulate iron assimilation in model and crop plants using transgenic sense and antisense approaches.
REFERENCE COUNT: 18 THERE ARE 18 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 2 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 2002:460905 HCAPLUS
TITLE: Identifying sugarcane expressed sequences associated with nutrient transporters and peptide metal chelators
AUTHOR(S): Figueira, Antonio; Kido, Ederson Akio; Almeida, Raul Santin
CORPORATE SOURCE: Centro de Energia Nuclear na Agricultura, Universidade de Sao Paulo, Piracicaba, 13400-970, Brazil
SOURCE: Genetics and Molecular Biology (2001), 24(1-4), 207-220
CODEN: GMBIFG; ISSN: 1415-4757
PUBLISHER: Sociedade Brasileira de Genetica
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Plant nutrient uptake is an active process, requiring energy to accumulate essential elements at higher levels in plant tissues than in the soil soln., while the presence of toxic metals or excess of nutrients requires mechanisms to modulate the accumulation of ions. Genes encoding ion transporters isolated from plants and yeast were used to identify sugarcane putative homologues in the sugarcane expressed sequence tag (SUCEST) database. Five cluster consensi with sequence homol. to plant high-affinity phosphate transporter genes were identified. One cluster consensus allowed the prediction of a full-length protein contg. 541 amino acids, with 81% amino acid identity to the Nicotiana tabacum NtPT1 gene, consisting of 12 membrane-spanning domains divided by a large hydrophilic charged region. Putative homologues to **Arabidopsis** thaliana micronutrient transporter genes were also detected in some of the SUCEST libraries. Iron uptake in grasses involves the release of the phytosiderophore mugeneic acid (MA) which chelate Fe3+ which is then absorbed by a specific transporter. Sugarcane expressed sequence tag (EST) homologous to genes coding for three enzymes of the mugeneic acid biosynthetic pathway [**nicotianamine synthase**; nicotianamine transferase; and putative mugeneic acid synthetase (ids3)] and a putative Fe3+-phytosiderophore transporter were detected. Seven sugarcane sequence clusters were identified with strong homol. to members of the ZIP gene family (ZIP1, ZIP3, ZIP4, IRT1 and ZNT1), while four

clusters homologous to ZIP2 and three to ZAT were found. Homologues to members of another gene family, Nramp, which code for broad-specificity transition metal transporters were also detected with constitutive expression. Partial transcripts homologous to genes encoding .gamma.-glutamylcysteine synthetase, glutathione synthetase, and phytochelatin synthase (responsible for biosynthesis of the metal chelator phytochelatin) and all four types of the major plant metal-chelator peptide metallothionein (MT) were identified: Type I MT being the most abundant (>1% of seed-library reads), followed by Type II which had a similar pattern of expression as that described for **Arabidopsis** MT. Identifying and understanding the expression of genes assocd. with nutrient uptake and metal tolerance could lead to the development of more nutrient-efficient sugarcane cultivars, or might allow the use of sugarcane as a hyper-accumulator plant for the restoration of contaminated areas in phytoremediation programs.

REFERENCE COUNT: 43 THERE ARE 43 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 3 OF 19 HCAPLUS COPYRIGHT 2002 ACS

ACCESSION NUMBER: 2002:30851 HCAPLUS

DOCUMENT NUMBER: 136:178713

TITLE: Analysis of upstream region of **nicotianamine synthase** gene from **Arabidopsis** thaliana: presence of putative ERE-like sequence

AUTHOR(S): Suzuki, Kazuya; Nakanishi, Hiromi; Nishizawa, Naoko K.; Mori, Satoshi

CORPORATE SOURCE: Laboratory of Plant Molecular Physiology, Department of Applied Biological Chemistry, The University of Tokyo, Tokyo, 113-8657, Japan

SOURCE: Bioscience, Biotechnology, and Biochemistry (2001), 65(12), 2794-2797
CODEN: BBBIEJ; ISSN: 0916-8451

PUBLISHER: Japan Society for Bioscience, Biotechnology, and Agrochemistry

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Nicotianamine (NA) is present in all plants so far examd., and is thought to chelate transition metal ions. Previously, we isolated three **nicotianamine synthase** (NAS) genes of **Arabidopsis** thaliana (AtNAS1, 2, and 3) and showed that each NAS gene is differentially expressed. Deletion anal. of the 5' flanking region of AtNAS3 found a putative ethylene-responsive sequence, ATTTTCAAA.

REFERENCE COUNT: 20 THERE ARE 20 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 4 OF 19 HCAPLUS COPYRIGHT 2002 ACS

ACCESSION NUMBER: 2001:840146 HCAPLUS

DOCUMENT NUMBER: 136:294231

TITLE: Increased iron efficiency in transgenic plants due to ectopic expression of nicotianamine synthase

AUTHOR(S): Douchkov, D.; Hell, R.; Stephan, U. W.; Baumlein, H.

CORPORATE SOURCE: Molecular Mineral Assimilation and Institut fur Pflanzengenetik und Kulturpflanzenforschung Gatersleben, Gatersleben, D-06466, Germany

SOURCE: Developments in Plant and Soil Sciences (2001), 92(Plant Nutrition), 54-55
CODEN: DVPSD8; ISSN: 0167-840X

PUBLISHER: Kluwer Academic Publishers

DOCUMENT TYPE: Journal

LANGUAGE: English

AB The plant-endogenous chelator for some metal micronutrients including iron, nicotianamine (NA), plays an important role in symplasmic and phloem transport of iron by keeping it in soln. at cytoplasmic pH (Stephan and Scholz, 1996). Exogenous supply of NA for plants suffering from iron deficiency resulted in a re-greening by better iron distribution within the plants. The same was obsd. with the iron-accumulating tomato mutant chloronerva, the only plant known to be NA-free. Thus, the enzyme NA synthase (NAS) was isolated from roots of barley grown under iron deficiency. The corresponding gene was cloned and successfully expressed

in E. coli. Furthermore, NAS sequences were isolated from genomic DNA of tomato and A. thaliana. They were introduced by Agrobacterium in sense and antisense constructs in A. thaliana, tobacco and tomato. Tobacco sense lines overexpressing NAS from A. thaliana were selected based on significantly increased NA concns. in the leaves compared to wild type plants. Plants of these lines grew faster, were green instead of chlorotic and exhibited a higher iron efficiency than wild type plants under iron limiting conditions. Crop plants with NAS overexpression thus could provide higher and more stable yield on areas of iron deficiency.

REFERENCE COUNT: 10 THERE ARE 10 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 5 OF 19 HCAPLUS COPYRIGHT 2002 ACS

ACCESSION NUMBER: 2001:580559 HCAPLUS

DOCUMENT NUMBER: 135:303367

TITLE: The expression of a **barley** HvNAS1 **nicotianamine synthase** gene promoter-gus fusion gene in transgenic tobacco is induced by Fe-deficiency in roots

AUTHOR(S): Higuchi, Kyoko; Tani, Masaharu; Nakanishi, Hiromi; Yoshiwara, Toshihiro; Goto, Fumiyuki; Nishizawa, Naoko K.; Mori, Satoshi

CORPORATE SOURCE: Laboratory of Plant Molecular Physiology, Department of Applied Biological Chemistry, The University of Tokyo, Tokyo, 113-8657, Japan

SOURCE: Bioscience, Biotechnology, and Biochemistry (2001), 65(7), 1692-1696
CODEN: BBBIEJ; ISSN: 0916-8451

PUBLISHER: Japan Society for Bioscience, Biotechnology, and Agrochemistry

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Nicotianamine (NA) is a precursor for mugineic acid-family phytosiderophores, which are a crit. component of the Fe acquisition process in graminaceous plants. In addn., **nicotianamine synthase** (NAS) is strongly induced in these plants by Fe deficiency. NA is essential for Fe metab. also in dicots, but NAS is not induced by Fe deficiency. The authors introduced a **barley** HvNAS1 promoter-gus fusion gene into tobacco. GUS activity was induced in the roots of these plants by Fe deficiency, and was constitutively expressed at a low level in their leaves.

REFERENCE COUNT: 21 THERE ARE 21 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 6 OF 19 HCAPLUS COPYRIGHT 2002 ACS

ACCESSION NUMBER: 2001:509590 HCAPLUS

DOCUMENT NUMBER: 136:197099

TITLE: Analysis of transgenic rice containing **barley** **nicotianamine synthase** gene

AUTHOR(S): Higuchi, Kyoko; Takahashi, Michiko; Nakanishi, Hiromi; Kawasaki, Shinji; Nishizawa, Naoko K.; Mori, Satoshi

CORPORATE SOURCE: Laboratory of Plant Molecular Physiology, Department of Applied Biological Chemistry, The University of Tokyo, Tokyo, 113-8657, Japan

SOURCE: Soil Science and Plant Nutrition (Tokyo, Japan) (2001), 47(2), 315-322
CODEN: SSPNAW; ISSN: 0038-0768

PUBLISHER: Japanese Society of Soil Science and Plant Nutrition

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Nicotianamine (NA) is an intermediate in the biosynthetic pathway of mugineic acid-family phytosiderophores (MAs), which are essential components of the iron acquisition mechanism of graminaceous plants. NA is also considered to be an essential chelator of metal cations in dicots. Thus, NA and **nicotianamine synthase** (NAS, EC 2.5.1.43) play important roles in Fe metab. and homeostasis in higher plants. To evaluate the contribution of NAS to MAs biosynthesis, we introduced the **barley** hvnas1 gene under the control of the CaMV35S promoter into rice. Transgenic rice contg. a **barley** HvNAS1 genomic DNA

fragment was also analyzed. Although significant expression of hvnas1 driven by the CaMV35S promoter was confirmed by Northern and Western analyses, total NAS activity, endogenous NA, and 2'-deoxymugineic acid (DMA) secretion were not higher under Fe-deficient conditions compared to vector control plants. However, under Fe-sufficient conditions, the amts. of endogenous NA and secreted DMA increased slightly. No accumulation of NA due to an altered balance of nicotianamine aminotransferase (NAAT) and NAS activities was obsd. These results indicate that the NAS activity may be strictly regulated.

REFERENCE COUNT: 21 THERE ARE 21 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 7 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 2001:132604 HCAPLUS
DOCUMENT NUMBER: 135:353484
TITLE: **Nicotianamine synthase** gene expression differs in **barley** and rice under Fe-deficient conditions
AUTHOR(S): Higuchi, Kyoko; Watanabe, Shunsuke; Takahashi, Michiko; Kawasaki, Shinji; Nakanishi, Hiromi; Nishizawa, Naoko K.; Mori, Satoshi
CORPORATE SOURCE: Laboratory of Plant Molecular Physiology, Core Research for Evolutional Science and Technology (CREST), Japan Science and Technology Corporation, Saitama, 332-0012, Japan
SOURCE: Plant Journal (2001), 25(2), 159-167
CODEN: PLJUED; ISSN: 0960-7412
PUBLISHER: Blackwell Science Ltd.
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Nicotianamine (NA) is an intermediate in the biosynthetic pathway of the mugineic acid family phytosiderophores (MAs), which are crucial components of the iron acquisition app. of graminaceous plants. In non-graminaceous plants, NA is thought to be an essential chelator for metal cation homeostasis. Thus NA plays a key role in Fe metab. and homeostasis in all higher plants. **Nicotianamine synthase** (NAS, EC 2.5.1.43) catalyzes the trimerization of S-adenosylmethionine to form one mol. of NA. **Barley**, a plant that is resistant to Fe deficiency, secretes large amts. of MAs, whereas rice, a plant that is susceptible to Fe deficiency, secretes only small amts. In this study we isolated a genomic fragment contg. HvNAS1 from **barley** and three rice cDNA clones, osnas1, osnas2 and osnas3, from Fe-deficient rice roots. We also isolated a genomic fragment contg. both OsNAS1 and OsNAS2. In contrast to **barley**, in which Fe deficiency induces the expression of NAS genes only in roots, Fe deficiency in rice induced NAS gene expression in both roots and chlorotic leaves. The amts. of endogenous NA in both the roots and leaves were higher than in **barley**. We introduced **barley** genomic DNA fragments contg. HvNAS1 with either 9 or 2 kb of the 5'-flanking region into rice, using Agrobacterium-mediated transformation. Fe deficiency induced HvNAS1 expression in both roots and leaves of the transgenic rice, as occurs with rice NAS genes. **Barley** and rice NAS genes are compared in a discussion of alteration of the NAS genes during adaptation to Fe deficiency.

REFERENCE COUNT: 33 THERE ARE 33 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 8 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 2000:40345 HCAPLUS
DOCUMENT NUMBER: 133:54316
TITLE: Cloning of **nicotianamine synthase** genes from **Arabidopsis** thaliana
AUTHOR(S): Suzuki, Kazuya; Higuchi, Kyoko; Nakanishi, Hiromi; Nishizawa, Naoko K.; Mori, Satoshi
CORPORATE SOURCE: CREST, Japan Science and Technology Corporation (JST), Tsukuba, 305-0047, Japan
SOURCE: Soil Science and Plant Nutrition (Tokyo) (1999), 45(4), 993-1002
CODEN: SSPNAW; ISSN: 0038-0768
PUBLISHER: Japanese Society of Soil Science and Plant Nutrition

DOCUMENT TYPE: Journal
LANGUAGE: English
AB **Nicotianamine synthase** (NAS) catalyzes the trimerization of S-adenosylmethionine to form one mol. of nicotianamine (NA). In order to identify the gene encoding NAS in dicotyledonous plants, **Arabidopsis** thaliana databases were searched using the nucleotide sequence of the NAS gene from **barley** (HvNAS), which was recently isolated. Several ESTs and 3 genomic sequences highly homologous to HvNAS were found in the databases. Based on these nucleotide sequences and that of HvNAS, 2 sets of primers were designed to isolate the NAS orthologs in **Arabidopsis** and 3 DNA clones encoding AtNAS (AtNAS1, 2, and 3) were obtained. These clones were expressed in Escherichia coli and their protein products displayed the NAS activity. The expression of AtNAS1 was detected in both shoots and roots of A. thaliana by RT-PCR; AtNAS3 expression was only detected in the shoots. In contrast, AtNAS2 expression was not detected in any organs.
REFERENCE COUNT: 40 THERE ARE 40 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 9 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1999:753329 HCAPLUS
DOCUMENT NUMBER: 132:971
TITLE: Nicotianamine synthase genes, isolation, sequencing and use for agricultutal and environmental purposes
INVENTOR(S): Baumlein, Helmut; Ganal, Martin; Herbik, Alexandra; Ling, Hong-qing; Mock, Hans-peter; Stephan, Udo
PATENT ASSIGNEE(S): Institut fur Pflanzengenetik und Kulturpflanzen Forschung, Germany
SOURCE: PCT Int. Appl., 15 pp.
CODEN: PIXXD2
DOCUMENT TYPE: Patent
LANGUAGE: German
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 9960107	A2	19991125	WO 1999-DE1585	19990518
WO 9960107	A3	20000323		
W: AE, AL, AM, AU, AZ, BA, BB, BG, BR, BY, CA, CN, CU, CZ, EE, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, RO, RU, SD, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM				
RW: GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG				
DE 19824307	A1	19991125	DE 1998-19824307	19980520
AU 9951507	A1	19991206	AU 1999-51507	19990518
BR 9902980	A	20010306	BR 1999-2980	19990719
PRIORITY APPLN. INFO.:			DE 1998-19824307 A	19980520
			WO 1999-DE1585 W	19990518

AB The invention relates to **nicotianamine synthase** genes, the isolation and use thereof. The invention can be used in agriculture and environmental protection. According to the invention, **nicotianamine synthases** and the genes coding for the latter are isolated and sequenced. Special embodiment examples are based on isolation from **barley** or tomatoes.

L4 ANSWER 10 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1999:723152 HCAPLUS
DOCUMENT NUMBER: 131:348530
TITLE: Cloning of cDNA for plant nicotianamine synthase and use for preparation of transgenic plants tolerant to iron deficiency
INVENTOR(S): Mori, Satoshi; Higuchi, Kyoko; Suzuki, Kazuya; Nishizawa, Naoko; Nakanishi, Hiromi
PATENT ASSIGNEE(S): Japan Science and Technology Corp., Japan
SOURCE: PCT Int. Appl., 83 pp.

CODEN: PIXXD2
DOCUMENT TYPE: Patent
LANGUAGE: Japanese
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 9957249	A1	19991111	WO 1999-JP2305	19990430
W: AU, CA, JP, US				
RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE				
CA 2327261	AA	19991111	CA 1999-2327261	19990430
AU 9936273	A1	19991123	AU 1999-36273	19990430
EP 1077255	A1	20010221	EP 1999-918274	19990430
R: DE, ES, FR, GB, IT, NL				

PRIORITY APPLN. INFO.: JP 1998-137685 A 19980430
WO 1999-JP2305 W 19990430

AB **Nicotianamine synthase** (NAS1), an enzyme in the of mugineic acid biosynthesis pathway, was isolated and purified from Hordeum vulgare cultivated in a medium lacking iron. The cDNA encoding the enzyme was cloned by PCR using the primers derived from the partially detd. N-terminal amino acid sequence. Cloning of the cDNA for the enzyme from **Oryza** sativa and **Arabidopsis** thaliana was also described. Claimed are methods of recombinant prepn. of NAS1, (monoclonal) antibodies to NAS1, transgenic plants or fruits expressing NAS1, and methods of purifn. of NAS1 in the presence of thiol protease inhibitors such as E-64. This gene can be used for the prepn. of transgenic plants, e.g., Gramineae, highly tolerant to iron deficiency.

REFERENCE COUNT: 5 THERE ARE 5 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 11 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1999:656714 HCAPLUS
DOCUMENT NUMBER: 132:10326
TITLE: Isolation, characterization and cDNA cloning of **nicotianamine synthase** from **barley**. A key enzyme for iron homeostasis in plants
AUTHOR(S): Herbik, A.; Koch, G.; Mock, H.-P.; Dushkov, D.; Czihal, A.; Thielmann, J.; Stephan, U. W.; Baumlein, H.
CORPORATE SOURCE: Institut fur Pflanzengenetik und Kulturpflanzenforschung (IPK), Gatersleben, D-06466, Germany
SOURCE: European Journal of Biochemistry (1999), 265(1), 231-239
CODEN: EJBCAI; ISSN: 0014-2956
PUBLISHER: Blackwell Science Ltd.
DOCUMENT TYPE: Journal
LANGUAGE: English

AB Basic cellular processes such as electron transport in photosynthesis and respiration require the precise control of iron homeostasis. To mobilize iron, plants have evolved at least two different strategies. The nonproteinogenous amino acid nicotianamine which is synthesized from three mols. of S-adenosyl-L-methionine, is an essential component of both pathways. This compd. is missing in the tomato mutant chloronerva, which exhibits severe defects in the regulation of iron metab. We report the purifn. and partial characterization of the **nicotianamine synthase** from **barley** roots as well as the cloning of two corresponding gene sequences. The function of the gene sequence has been verified by overexpression in Escherichia coli. Further confirmation comes from redn. of the nicotianamine content and the exhibition of a chloronerva-like phenotype due to the expression of heterologous antisense constructs in transgenic tobacco plants. The native enzyme with an apparent Mr of .apprxeq. 105 000 probably represents a trimer of S-adenosyl-L-methionine-binding subunits. A comparison with the recently cloned chloronerva gene of tomato reveals striking sequence homol., providing support for the suggestion that the destruction of the

nicotianamine synthase encoding gene is the mol. basis of the tomato mutation.
REFERENCE COUNT: 38 THERE ARE 38 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 12 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1999:647368 HCAPLUS
DOCUMENT NUMBER: 132:76041
TITLE: Presence of nicotianamine synthase isozymes and their homologues in the root of graminaceous plants
AUTHOR(S): Higuchi, Kyoko; Nakanishi, Hiromi; Suzuki, Kazuya; Nishizawa, Naoko K.; Mori, Satoshi
CORPORATE SOURCE: Laboratory of Plant Molecular Physiology, Department of Applied Biological Chemistry, The University of Tokyo, Tokyo, 113-8657, Japan
SOURCE: Soil Science and Plant Nutrition (Tokyo) (1999), 45(3), 681-691
CODEN: SSPNAW; ISSN: 0038-0768
PUBLISHER: Japanese Society of Soil Science and Plant Nutrition
DOCUMENT TYPE: Journal
LANGUAGE: English
AB **Nicotianamine synthase** (NAS) catalyzes the synthesis of nicotianamine, which is an intermediate in the biosynthetic pathway of mugineic acid family phytosiderophores (MAs). Using polyclonal anti-NAS antibodies and recombinant NAS proteins, five NAS isoenzymes and one NAS homolog were identified in Fe-deficient **barley** roots using two-dimensional electrophoresis followed by Western blot anal. Other unidentified NAS homologues that were induced by Fe-deficiency were also detected in **barley** roots. Western anal. enabled to detect NAS homologues in wheat, oats, rice, maize, and sorghum roots. In graminaceous species, both the amt. and no. of NAS homologues were correlated with the total NAS activity and Fe-deficiency tolerance. The NAS isoform patterns differed among the graminaceous plants.
REFERENCE COUNT: 15 THERE ARE 15 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 13 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1999:461782 HCAPLUS
DOCUMENT NUMBER: 131:209894
TITLE: Map-based cloning of chloronerva, a gene involved in iron uptake of higher plants encoding nicotianamine synthase
AUTHOR(S): Ling, Hong-Qing; Koch, Gudrun; Baumlein, Helmut; Ganal, Martin W.
CORPORATE SOURCE: Institute for Plant Genetics and Crop Plant Research, Gatersleben, D-06466, Germany
SOURCE: Proceedings of the National Academy of Sciences of the United States of America (1999), 96(12), 7098-7103
CODEN: PNASA6; ISSN: 0027-8424
PUBLISHER: National Academy of Sciences
DOCUMENT TYPE: Journal
LANGUAGE: English
AB The uptake of iron in plants is a highly regulated process that is induced on iron starvation. In tomato, the mutant chloronerva exhibits constitutive expression of iron uptake responses and intercostal chlorosis. Biochem., chloronerva is an auxotroph for nicotianamine, a key polyamine in plant iron uptake metab. The chloronerva gene has been fine-mapped onto the long arm of chromosome 1 in a large segregating tomato population and yeast artificial chromosome clones encompassing the region were isolated by using flanking markers. A cosmid contig contg. the chloronerva gene was established, and complementing cosmids were identified by transformation into the mutant. The chloronerva transcript was identified by cDNA isolation using the complementing cosmids. The gene encodes a unique protein of 35 kDa. The mutant harbors a single base change compared with the wild type. Based on enzyme activity and sequence similarity to the coding DNA sequence of the purified **barley** enzyme the chloronerva gene encodes the enzyme **nicotianamine synthase**.
REFERENCE COUNT: 27 THERE ARE 27 CITED REFERENCES AVAILABLE FOR THIS

RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 14 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1999:424322 HCAPLUS
DOCUMENT NUMBER: 131:226058
TITLE: Iron acquisition by plants
AUTHOR(S): Mori, Satoshi
CORPORATE SOURCE: Laboratory of Plant Molecular Physiology, Department of Applied Biological Chemistry, The University of Tokyo, Tokyo, 113-8657, Japan
SOURCE: Current Opinion in Plant Biology (1999), 2(3), 250-253
CODEN: COPBFZ; ISSN: 1369-5266
PUBLISHER: Current Biology Publications
DOCUMENT TYPE: Journal; General Review
LANGUAGE: English
AB A review with 33 refs. In nongraminaceous plants, the FeII-transporter gene and ferric-chelate reductase gene have been cloned from **Arabidopsis** thaliana, whereas FeIII-reductase has not. In graminaceous monocots, the genes for mugineic acids (MAs) synthesis, nas (**nicotianamine synthase**) and naat (nicotianamine aminotransferase), have been cloned from **barley**, whereas the FeIII-MAs transporter gene is yet to be cloned. Transferrin absorption in Dunaliella has been reported, suggesting a phagocytotic (endocytotic) Fe-acquisition mechanism. Work to develop transgenic cultivars tolerant to Fe-deficiency in calcareous soils is now in progress.
REFERENCE COUNT: 33 THERE ARE 33 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 15 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1999:150695 HCAPLUS
DOCUMENT NUMBER: 131:1306
TITLE: Cloning of nicotianamine synthase genes, novel genes involved in the biosynthesis of phytosiderophores
AUTHOR(S): Higuchi, Kyoko; Suzuki, Kazuya; Nakanishi, Hiromi; Yamaguchi, Hirotaka; Nishizawa, Naoko-Kishi; Mori, Satoshi
CORPORATE SOURCE: Laboratory of Plant Molecular Physiology, Department of Applied Biological Chemistry, The University of Tokyo, Tokyo, 113-8657, Japan
SOURCE: Plant Physiology (1999), 119(2), 471-479
CODEN: PLPHAY; ISSN: 0032-0889
PUBLISHER: American Society of Plant Physiologists
DOCUMENT TYPE: Journal
LANGUAGE: English
AB **Nicotianamine synthase** (NAS), the key enzyme in the biosynthetic pathway for the mugineic acid family of phytosiderophores, catalyzes the trimerization of S-adenosylmethionine to form one mol. of nicotianamine. The authors purified NAS protein and isolated the genes nas1, nas2, nas3, nas4, nas5-1, nas5-2, and nas6, which encode NAS and NAS-like proteins from Fe-deficient **barley** (Hordeum vulgare L. cv Ehimehadaka no. 1) roots. Escherichia coli expressing nas1 showed NAS activity, confirming that this gene encodes a functional NAS. Expression of nas genes as detd. by northern-blot anal. was induced by Fe deficiency and was root specific. The NAS genes form a multigene family in the **barley** and rice genomes.
REFERENCE COUNT: 36 THERE ARE 36 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L4 ANSWER 16 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1996:586037 HCAPLUS
DOCUMENT NUMBER: 125:239625
TITLE: A strategy for cloning the genes in the synthetic pathway of mugineic acid-family phytosiderophores
AUTHOR(S): Mori, S.
CORPORATE SOURCE: Faculty Agriculture, University Tokyo, Tokyo, 113, Japan
SOURCE: Genetic Manipulation of Crop Plants to Enhance Integrated Nutrient Management in Cropping Systems--1. Phosphorus, Proceedings ofan FAO-ICRISAT Expert

Consultancy Workshop, Patancheru, India, Mar. 15-18, 1994 (1995), Meeting Date 1994, 129-144. Editor(s): Johansen, C. International Crops Research Institute for the Semi-Arid Tropics: Patancheru, India.
CODEN: 63KAAB
DOCUMENT TYPE: Conference
LANGUAGE: English
AB Genes involved in the biosynthetic pathway of mugineic acid-family phytosiderophores were cloned. Initially, the genes for **nicotianamine synthase** and nicotianamine aminotransferase were confirmed to be induced by iron (Fe) deficiency and were partially purified. The partial amino acid sequences of the "d" peptide were detd. on 2D-PAGE, which appeared to be specific to Fe-deficient **barley** roots. Finally, seven Fe-deficiency specific clones were selected by "differential screening" of a cDNA library constructed from Fe-deficient **barley** roots and three DNA clones (Ids1, Ids2, and Ids3) were sequenced from amongst these. Strategies to clone the genes essential for the synthesis of phytosiderophores are discussed.

L4 ANSWER 17 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1996:202215 HCAPLUS
DOCUMENT NUMBER: 124:259698
TITLE: The role of nicotianamine synthase in response to Fe nutrition status in Gramineae
AUTHOR(S): Higuchi, Kyoko; Kanazawa, Kenji; Nishizawa, Naoko-Kishi; Mori, Satoshi
CORPORATE SOURCE: Dep. Appl. Biol. Chem., Univ. Tokyo, TOkyo, 113, Japan
SOURCE: Plant and Soil (1996), 178(2), 171-7
CODEN: PLSOA2; ISSN: 0032-079X
PUBLISHER: Kluwer
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Nicotianamine is an intermediate for the biosynthesis of mugineic acid-family phytosiderophores (MAs) in the Gramineae and a key substance for iron metab. in dicots. **Nicotianamine synthase** catalyzes the formation of nicotianamine from S-adenosylmethionine. **Nicotianamine synthase** activity was induced in **barley** roots at the 3rd day after withholding Fe supply and declined within one day following the supply of Fe3+-epihydroxymugineic acid. The induction **nicotianamine synthase** activity by Fe-deficiency was obsd. also in sorghum, maize, and rye, and the level of **nicotianamine synthase** activity was highly assocd. with the MAs secreted among graminaceous plant tested. Therefore, the **nicotianamine synthase** gene may be a suitable candidate for making a transgenic plant tolerant to Fe-deficiency.

L4 ANSWER 18 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1995:771685 HCAPLUS
DOCUMENT NUMBER: 123:165182
TITLE: Response of **nicotianamine synthase** activity to Fe-deficiency in tobacco plants as compared with **barley**
AUTHOR(S): Higuchi, Kiyoko; Nishizawa, Naoko-Kishi; Yamaguchi, Hirotaka; Roemheld, Volker; Marschner, Horst; Mori, Satoshi
CORPORATE SOURCE: Fac. Agric. Agric. Life Sci., Univ. Tokyo, Tokyo, 113, Japan
SOURCE: Journal of Experimental Botany (1995), 46(289), 1061-3
CODEN: JEBOA6; ISSN: 0022-0957
PUBLISHER: Oxford University Press
DOCUMENT TYPE: Journal
LANGUAGE: English
AB In vitro **nicotianamine synthase** activity was measured in tobacco under Fe-deficient or Fe-sufficient conditions. Its activity was not induced by Fe-deficiency, in contrast to **barley** roots, implying that the mol. biol. regulation of **nicotianamine synthase** in response to Fe-deficiency may be different between tobacco and **barley**.

L4 ANSWER 19 OF 19 HCAPLUS COPYRIGHT 2002 ACS
ACCESSION NUMBER: 1995:319128 HCAPLUS
DOCUMENT NUMBER: 122:183289
TITLE: Purification and characterization of **nicotianamine synthase** from Fe-deficient **barley** roots
AUTHOR(S): Higuchi, Kyoko; Kanazawa, Kenji; Nishizawa, Naoko-Kishi; Chino, Mitsuo; Mori, Satoshi
CORPORATE SOURCE: Lab. Plant nutrition Fertilizers, Univ. Tokyo, Tokyo, 113, Japan
SOURCE: Plant and Soil (1994), 165(2), 173-9
CODEN: PLSOA2; ISSN: 0032-079X
PUBLISHER: Kluwer
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Nicotianamine (NA), the key precursor of the mugineic acid family phytosiderophores (MAs), is synthesized from S-adenosylmethionine (SAM). NA synthase was strongly induced by Fe-deficiency treatment, and the activity increased to the max. level faster than the time of max. level of MAs secretion and also before the appearance of severest chlorosis. The enzyme was mainly localized in the roots of barley. NA synthase had an optimum pH at 9.0, a mol. wt. of .apprx.40,000-50,000 estd. by gel filtration or .apprx.30,000 by SDS-PAGE. Using hydrophobic chromatog., hydroxylapatite chromatog., and preparative SDS-PAGE, NA synthase was purified as 1 band on SDS-PAGE.